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New data on Tineidae and Meessiidae from the Canary Islands, Spain (Lepidoptera: Tineoidea)

P. Falck, R. Gaedike & A. Vives Moreno

Abstract

The list of Tineidae and Meessiidae from the Canary Islands is updated. Two species are described: *Rhodobates carsteni* Falck, Gaedike & Vives, sp. n. (Spain: Lanzarote) and *Tinea laurisilvaella* Falck, Gaedike & Vives, sp. n. (Spain: La Gomera, Gran Canaria, Tenerife, Portugal: Madeira). The female genitalia of *Infurcitinea canaricola* Gaedike, 2019 (Spain: La Palma) is described, hitherto only known from one male. Two species are recorded for the first time from the Canary Islands: *Nemapogon variatella* (Clemens, 1860) (Tenerife) and *Elatobia fuliginosella* (Lienig & Zeller, 1846) (Tenerife) and one species *Tinea trinotella* Thunberg, 1794 is removed from the list. Adults and genitalia of the new species and *I. canaricola* are illustrated. The taxonomic results are supported by DNA barcodes from sequencing of the 658 bp fragment of the mitochondrial COI gene.
KEY WORDS: Lepidoptera, Tineoidea, new species, Canary Islands (Spain), Madeira (Portugal).

Nuevos datos sobre Tineidae y Meessiidae de las Islas Canarias, España (Lepidoptera: Tineoidea)

Resumen

Se actualiza la lista de Tineidae y Meessiidae de las Islas Canarias. Se describen dos especies: *Rhodobates carsteni* Falck, Gaedike & Vives, sp. n. (Spain: Lanzarote) y *Tinea laurisilvaella* Falck, Gaedike & Vives, sp. n. (Spain: La Gomera, Gran Canaria, Tenerife, Portugal: Madeira). Se describe la hembra de *Infurcitinea canaricola* Gaedike, 2019 (Spain: La Palma), sólo se conocía de un macho. Por primera vez, se registran dos especies nuevas de las Islas Canarias: *Nemapogon variatella* (Clemens, 1860) (Tenerife) y *Elatobia fuliginosella* (Lienig & Zeller, 1846) (Tenerife) y se remueve una especie de la lista *Tinea trinotella* Thunberg, 1794. Se ilustra el adulto y la genitalia de la nueva especie *I. canaricola*. Los resultados taxonómicos son respaldados por el código de barras de ADN de la secuencia del fragmento de 658 pb del gen mitocondrial COI.
PALABRAS CLAVE: Lepidoptera, Tineoidea, nuevas especies, Islas Canarias (España), Madeira (Portugal).

Introduction

Based on recent field work and especially on DNA barcoding of several specimens of Tineidae we are able to make an update of the checklist of the Tineidae fauna from the Canary Islands (GAEDIKE & FALCK, 2019). We record two species as new to the Canary Islands: *Nemapogon variatella* (Clemens, 1860) and *Elatobia fuliginosella* (Lienig & Zeller, 1846), describe the female genitalia of *Infurcitinea canaricola* Gaedike, 2019 hitherto only known from the holotype and describe two new species of the genus *Rhodobates* and *Tinea.* The genus *Rhodobates* Ragonot, 1895 (Hapsiferinae, Tineidae) comprises medium sized moths with broad fore and hindwings. It is known from 19 species in the Palaeartic region and two species from East and South Africa (GAEDIKE, 2015: 20). Two species and one subspecies

Rhodobates canariensis Petersen & Gaedike, 1979, *Rhodobates pinkeri pinkeri* Petersen, 1987 and *Rhodobates pinkeri gomerae* Petersen, 1987 were hitherto recorded in this family from the Canary Islands (VIVES MORENO, 2014: 71). The genus *Tinea* Linnaeus, 1758 (Tineinae, Tineidae) comprises small to medium sized, mostly unicolourous moths, forewing often with a hyaline stripe at the base. It includes about 70 species worldwide (GAEDIKE, 2019a: 52-53) and 16 species from Europe. Seven species have been recorded from the Canary Islands (GAEDIKE & FALCK; 2019: 515).

Material and methods

Almost all the specimens were attracted to artificial light, and a few specimens were reared from dead wood overgrown with fungus. Label data are listed in a standardized way under each species, with the islands in alphabetic sequence, and the records in chronological order. Data on holotypes are cited literally from their labels.

A part of the material was subjected to DNA barcoding (sequencing of the 658 bp fragment of the mitochondrial COI gene) for detection of genetically distinct taxa and for obtaining molecular data for new species. The K2P divergences between the examined taxa were calculated using analytic tools in BOLD systems. To examine how isolated the Canary Island populations are from European populations of *Tinea trinotella* Thunberg, 1794 we calculated the pairwise F_{st} value between a group comprising the three Canary Island specimens CILEP001-19, CILEP212-19, and CILEP213-19 (CILEP099-19 had to be omitted due to too much missing data), and a group comprising 12 of the public available sequences from European specimens on BOLD in Arlequin 3.5.2.2 (EXCOFFIER *et al*., 2005) with 10,000 permutations to test for statistical significance.

The photographs of specimens were taken with Canon EOS700D camera. Those of the genitalia by using a Soptop CX40T Trinocular microscope and a Toup Tek P10500A-E3 / E3ISPM05000KPA-E3 / 5.0MP USB3 camera.

Abbreviations used

coll. H. Roweck	Hartmut Roweck, Kiel, Germany
coll. A. Werno	Andreas Werno, Nunkirchen, Germany
GP	Genitalia preparation
MNCN	Collection of Antonio Vives, Museo Nacional de Ciencias Naturales, Madrid, Spain
PF	Collection of Per Falck, Neksø, Denmark
RG	Reinhard Gaedike, Bonn, Germany
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany
ZMUC	Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark

Results

MEESSIIDAE

Infurcitinea canaricola Gaedike, 2019 (Fig. 2)
Infurcitinea canaricola Gaedike, 2019. *SHILAP Revta. lepid*., **47**(185): 79
LT: Arafo, Tenerife, Spain

Material examined: SPAIN, La Palma. La Galga, 400 m, 1 ♂, 2 ♀♀, 17-23-I-2019, larvae in dead wood, leg. P. Falck, Genitalia slides 3035PF, 3038PF, 9726RG, DNA sample Lepid Phyl 0101PF, 0102PF (PF).

The specimens were reared from a piece of dead wood overgrown with fungi, growing in the dark part of a Laurisilva Forest. *I. canaricola* is hitherto only known from the male holotype "ES (Spain), Tenerife, Arafo, e. l., 29-IV-2010, leg. J. Hilszczánski" (GAEDIKE, 2019b: 79). This enables us to describe the female genitalia.

Genitalia ♂ (Fig. 7)

Genitalia ♀ (Fig. 8): Anterior apophysis not forked, slightly longer than posterior apophysis, ostium surrounded with nearly invisible rounded sclerotizations.

Remarks: The female genitalia structure is not clearly distinguishable from that of *I. toechophila* (Walsingham, 1908). In the paper with the original description of *I. canaricola* (GAEDIKE, 2019b: 85) a mistake in numbering of the illustrations occurred (see GAEDIKE, 2019c: 436).

TINEIDAE
HAPSIFERINAE

***Rhodobates carsteni* Falck, Gaedike & Vives, sp. n.** (Figs 3-4)

Material examined: Holotype ♂, "SPAIN, Lanzarote, Mojón Blanco, Orzola, 20 m, 21-X-10-XI-2019, leg. P. Falck" (ZMUC). Paratypes: SPAIN, Lanzarote, El Bosquecillo, 600 m, 2 ♂♂, 6-XI-2018, leg. B. Skule & C. Hviid, Genitalia slide 2972PF (ZMUC); 0.8 km S. Concil, 1.4 km N. Tias, 240 m, 1 ♂, 2-8-XI-2018, leg. B. Skule & C. Hviid, (ZMUC); Mojón Blanco, Orzola, 20 m, 23 ♂♂, 2 ♀♀, 21-X-10-XI-2019, leg. P. Falck, Genitalia slides 3246PF, 3247PF, 3251PF, 3254PF, 3256PF, DNA samples Lepid Phyl 0304PF, 0305PF, 0312PF (PF, MNCN, SDEI).

Description: Wingspan 13-15 mm (male), 16 mm (female). Head brush grey brown with white tips; labial palpus cream colored, laterally grey brown, segment 2 with two lateral bristles, ventrally with long erect scales, segment 3 directed upwards; antenna (male) almost as long as forewing, dark grey brown, scape ventrally whitish colored, female antenna a little shorter. Thorax pale creamy, overlaid with some darker scales; tegulae nearly complete dark brown. Forewing pale creamy to grey, with a pattern of dark grey brown scales, costa with approximately 8-10 short dark stripes, from base to about ½ and beyond the cell an irregularly black streak; in the middle at the end of cell a distinct creamy white patch, surrounded towards dorsum by a dark, nearly black band; fringes with two thin darker scale-lines. Hindwing light grey. Abdomen brown.

Genitalia ♂ (Figs 9, 9a, 9b): Uncus distally notched, laterally each arm with more or less triangular tip, the edges more strongly sclerotized; gnathos arms fused, distal edge laterally each with triangular process, in the middle with two smaller pointed tips, the entire edge strongly sclerotized; valva as long as uncus-tegumen complex, parallel sided, costal edge somewhat curved upwards, ventral edge from last third to apex sickled-shaped narrowed, apex blunt, sacculus broad, distally angular; phallus clearly longer than the valva, straight, apically S-shaped, with 6-10 minute cornuti.

Genitalia ♀ (Fig. 10): Sternite VIII with broad excavation, ostium funnel-shaped, distal edge of tergite VIII wave-shaped; the area around ostium with numerous sclerotizations.

DNA barcodes (Fig. 1): We obtained full length DNA barcodes from three specimens from the island of Lanzarote. The barcodes fall in Barcode Index Number (BIN): BOLD AEC3591. The intraspecific distance is 0%. The distance to nearest neighbor *R. pinkeri* is 6.58 %, with the Barcode index number (BIN) BOLD:AEC4072.

Diagnosis: *R. carsteni* resembles *R. pinkeri* and *R. canariensis*. It can be distinguished by its smaller average size, the long antenna and the labial palpus with only two long bristles (4-5 bristles in the other Canarian and West Palaearctic *Rhodobates* species), and the forewing pattern with the creamy white patch towards dorsum surrounded by a black band. In the male genitalia it differs from *R. canariensis* and *R. pinkeri* in the shape of gnathos arms with the lateral processes and the two pointed tips; sacculus distally angular shaped; apex of phallus clearly S-shaped. In *R. canariensis* the gnathos arms are broadly fused, distally in the middle only with a weak notch; sacculus broad tapering distally; phallus weakly S-shaped. In *R. pinkeri* the gnathos arms are broadly fused, distally with a deep rounded notch; sacculus tapering, almost pointed distally; phallus clearly S-shaped. The clearly S-shaped phallus of *R. carsteni* separates it from the two other West Palaearctic species *R. friedeli* Petersen, 1987 and *R. unicolor* (Staudinger, 1871). The female genitalia are not clearly distinguishable.

Biology: Unknown. The specimens were all collected in late October to mid-November at light. The type-locality is a dry, sandy area near the coast.

Distribution: Only known from a few scattered localities in Lanzarote, Spain.

Etymology: The species is named after one of the collectors of the first known specimens, the Danish lepidopterologist Carsten Hviid.

Remarks: In the paper by GAEDIKE & FALCK (2019) some specimens from Lanzarote of this new species were erroneously identified as *R. pinkeri pinkeri* Petersen, 1987.

According to VIVES MORENO (2014), this species should be placed after *Rhodobates pinkeri* Petersen, 1987.

NEMAPOGONINAE

Nemapogon variatella (Clemens, 1860)
Tinea variatella Clemens, 1960. *Proc. Acad. nat. Sci. Phil*., **11**: 257
LT: [Philadelphia], USA

Material examined: SPAIN, Tenerife, Santa Cruz, 1 ♂, 1 ♀, 12-III-2019, leg N. Savenkov (coll. H. Roweck); Aguamansa, 1050 m, 4 ♂♂, 2 ♀♀, 21-V-3-VI-2019, leg. P. Falck, Genitalia slide 3032PF (PF), ibidem, 1 ♂, 13-26-VIII-2019, leg. P. Falck (PF). **New to the Canary Islands.**

Two of the specimens from Aguamansa were collected flying actively in the afternoon sunshine, the other specimens were reared from a fungus growing on a stem of *Erica arborea* L. *N. variatella* is widespread in Europe, outside Europe from Northern Africa, from Middle to Far East, introduced into Central and South America (GAEDIKE, 2015: 66).

TINEINAE

Elatobia fuliginosella (Lienig & Zeller, 1846)
Tinea fuliginosella Lienig & Zeller, 1846. *Isis von Oken*, **1846**: 273
LT: Livonia [Estonia, Latvia]

Material examined: SPAIN, Tenerife, Las Manchas, 1050 m, 1 ♂, 21-V-3-VI-2019, leg. P. Falck (PF); Aguamansa, 1050 m, 1 ♀, 13-26-VIII-2019, leg. P. Falck (PF). **New to the Canary Islands.**

Both specimens were attracted to light in the lower part of the pine forest. *E. fuliginosella* is widely distributed in Europe and outside Europe known from Morocco, Tunisia, Turkey, through to Siberia the Far East and in the Nearctic region (GAEDIKE, 2019a: 48).

Tinea laurisilvaella **Falck, Gaedike & Vives, sp. n.** (Figs 5-6)

Material examined: Holotype ♂, SPAIN, Tenerife, Barranco Ruiz, leg. R. Pinker, Genitalia slide 1997RG (SDEI) [in GAEDIKE, 2019a figured as figure 243e under the name *T. trinotella* Thunberg, 1794]. Paratypes: SPAIN, La Gomera, El Cedro, 1000 m, 1 ♀, 24-VII-1984, leg. P. Olsen, B. Skule & P. Stadel (ZMUC); Gran Canaria, Los Tilos de Moya, 500 m, 1 ♀, 11-24-VI-2018 leg P. Falck, ibidem 1 ♂, 4-23-III-2019, leg. P. Falck, Genitalia slides 2978PF, 3046PF, DNA sample Lepid Phyl 0001PF, 0100PF (PF); Tenerife, El Bebedero, La Vinca 58, 1 ♂, 27-III-2010, leg. A. Werno (coll. A. Werno); Las Mercedes, 750 m, 2 ♂♂, 1 ♀, 21-V-3-VI-2019, leg. P. Falck, DNA samples Lepid Phyl 0213PF, 0214PF (PF); Aguamansa, 1050 m, 1 ♂, 1 ♀, 13-26-VIII-2019, leg P. Falck (PF, MNCN). PORTUGAL, Madeira, Pousada, Serra d'Agua, 660 m, 1 ♂, 31-VII-1975 leg. N. L. Wolff (ZMUC); SW. Porto do Moniz, Santa Madalena, Pico Alto, 600 m, 1 ♀, 9-VII-1991, leg. M. Meyer (coll. A. Werno); N. Pto. Encumeada, Lamaceiros, 900 m, 1 ♀, 11-VII-1991, leg. M. Meyer, Genitalia slide 2978PF (ZMUC); Funchal, 4.5 km N. of Santo Antonio, 50 m, 30-IV-3-V-2009, leg. C. Hviid (ZMUC).

Description: Wingspan 12.5-18.5 mm. Head brush and frons yellow brown; labial palpus yellowish white, segment 2 laterally dark brown and bristled; antenna dark brown. Thorax off-white, tegulae off-white, basally dark brown. Forewing off-white, with heavy suffusion of black in the apical third, costa

black in the basal half; at 1/3 below cell a distinct black spot, at dorsum well before tornus a minute black spot; fringe and fringe-line dark grey. Hindwing dark grey. Abdomen dark grey.

Variation: In some specimens from Madeira the black suffusion of the forewing is very pronounced (Fig. 6).

Genitalia ♂ (Figs 11, 11a): Uncus basally broad, narrower to the rounded tip, lobes are fused to form a hook-like structure; saccus narrow and short; gnathos elongate, appressed in mid-line; valva longer than uncus-tegumen-complex, apodemes long, costal edge straight after ½ obliquely narrower, ventral edge almost straight, towards apex rounded, apex rounded; phallus straight, as long as valva, base rounded tapering towards apex.

Genitalia ♀ (Fig. 12): Posterior apophysis about three times longer than segment VIII, anterior apophysis about 2/3 the length of the posterior apophysis; segment VIII with a deep narrow U-shaped emargination; ostium covered with minute spines; ductus bursae distally with a more sclerotized ring; corpus bursae ovoid.

DNA barcodes (Fig. 1): We obtained full-length DNA barcodes from two specimens from the island of Tenerife; and DNA barcode fragments of 637 bp and 523 bp from two specimens from the island of Gran Canaria; from one specimen from the island of Madeira barcoding failed twice. All barcodes fall within Barcode Index Number (BIN) BOLD: ADT6529. The intraspecific distance is 0 - 0.81% (mean 0.46%, n=4) with the largest distance between specimens from Tenerife and Gran Canaria. The distance between the Tenerife specimens is 0,15%, and the Gran Canaria specimens 0%. The distance to nearest neighbor *T. trinotella* is 2.87%, with the Barcode index number (BIN) BOLD: AAD5562. The pairwise F_{ST} between Canary Island specimens and European specimens is 0.84756 (statistically significant, $p < 0.05$). As the F_{ST} value ranges between 0.0 and 1.0 with the former indicating no isolation and full inbreeding, and the latter indicating full isolation and no inbreeding (MEIRMANS & HEDRICK, 2011), the result indicates a high degree of isolations, and support separate species status for the Canary Island populations.

Diagnosis: *Tinea laurisilvaella* resembles *T. trinotella.* It can be distinguished by the off-white ground-color and the blackish apical third of the forewing; lack of the minute black spot at 1/3 above the cell and lack of the distinct black spot at the end of the cell. In the male and the female genitalia there are no clear differences.

Biology: Unknown. The specimens were collected from late April to late August at light.

Distribution: Known from Spain (La Gomera, Gran Canaria, Tenerife) and Portugal (Madeira).

Etymology: The species is named after the Laurisilva Forest, where most of the specimens are collected.

Remarks: For many years the identity of *Tinea trinotella* Thunberg, 1794 from the Canary Islands has been questioned. REBEL (1906: 40) mentions a worn specimen from Tenerife (Güimar) collected by W. White in 1906, identified as *Tinea lapella* Hübner, [1799] 1796: 252, nec [Denis & Schiffermüller], 1775: 142 (homonym), and he describes the specimen as "weicht von typischen Stücken Mitteleuropas nur dadurch ab, daß die Flügel mehr grau als braun gefärbt erscheinen. Der schwarze Fleck in der Falte der Vorderflügel ist sehr groß und deutlich, jener am Schlusse der Mittelzelle fehlt" and later "Trotzdem dürfte vielleicht eine davon verschiedene Art vorliegen." Also WALSINGHAM (1908: 1025) examined the specimen and concluded "I examined Mr. White's specimen and do not think it is *lapella* Hb., the wings seem broader, and there is no spot at the end of the cell, the color also looks wrong". Walsingham did not collect the species himself and "was unable to compare it with European specimens"; that is probably why he did not describe the species as new. In later works (KLIMESCH, 1980: 98; GAEDIKE & KARSHOLT, 2001: 172; GAEDIKE, 2019: 243) on the Tineidae from The Canary Islands and Madeira the species was treated as *T. trinotella* because of the similarity in the genitalia.

We describe *T. laurisilvaella* sp. n. based on the constant difference in the adult morphology and the distinct barcode. *T. trinotella* should be removed from the list of Canary Island Lepidoptera and replaced by *T. laurisilvaella*.

According to VIVES MORENO (2014), this species should be placed after *Tinea trinotella* Thunberg, 1794.

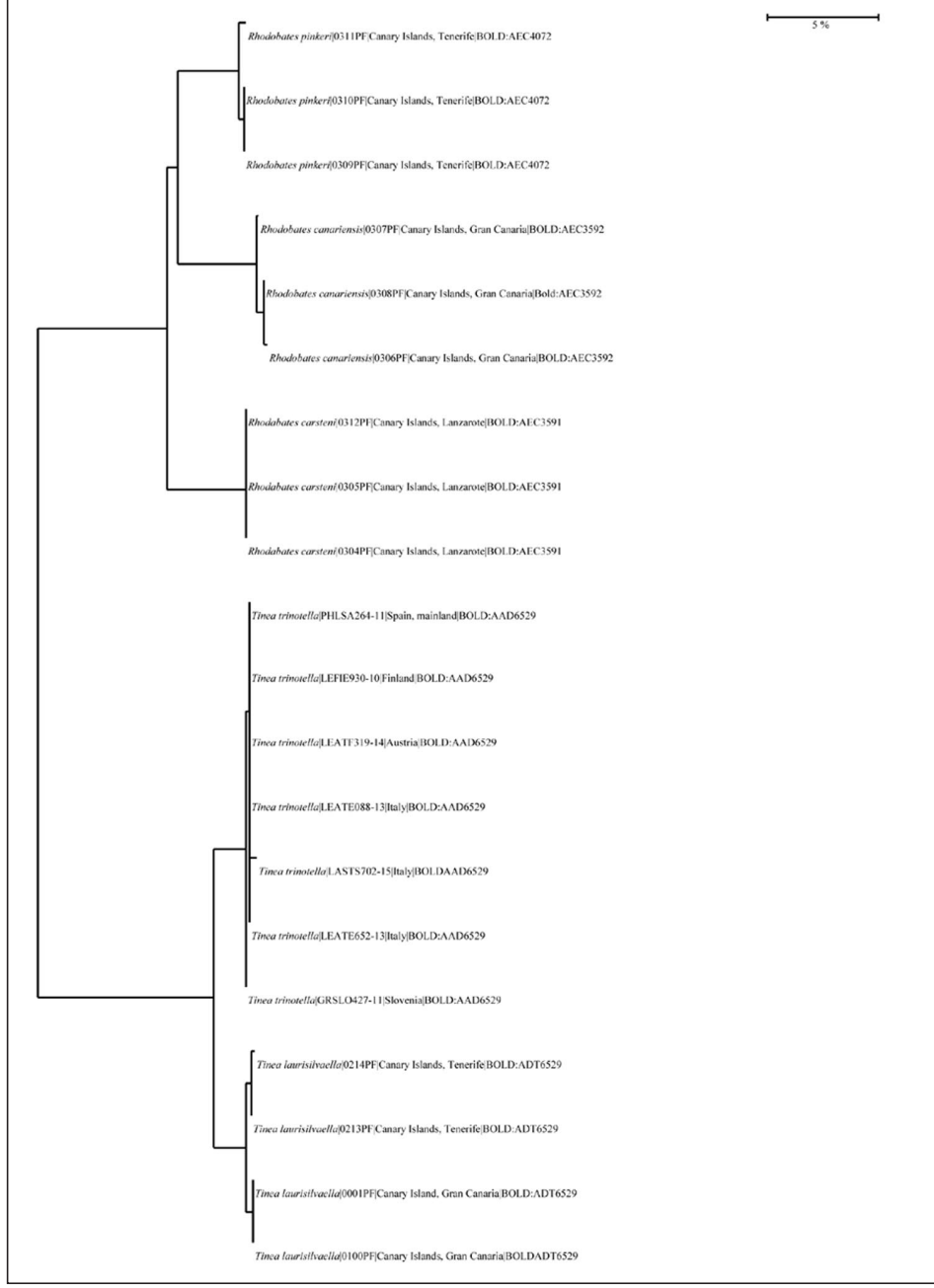

Fig. 1.– Neighbor Joining tree of DNA barcodes of three specimens of *Rhodobates* and two species of *Tinea*.

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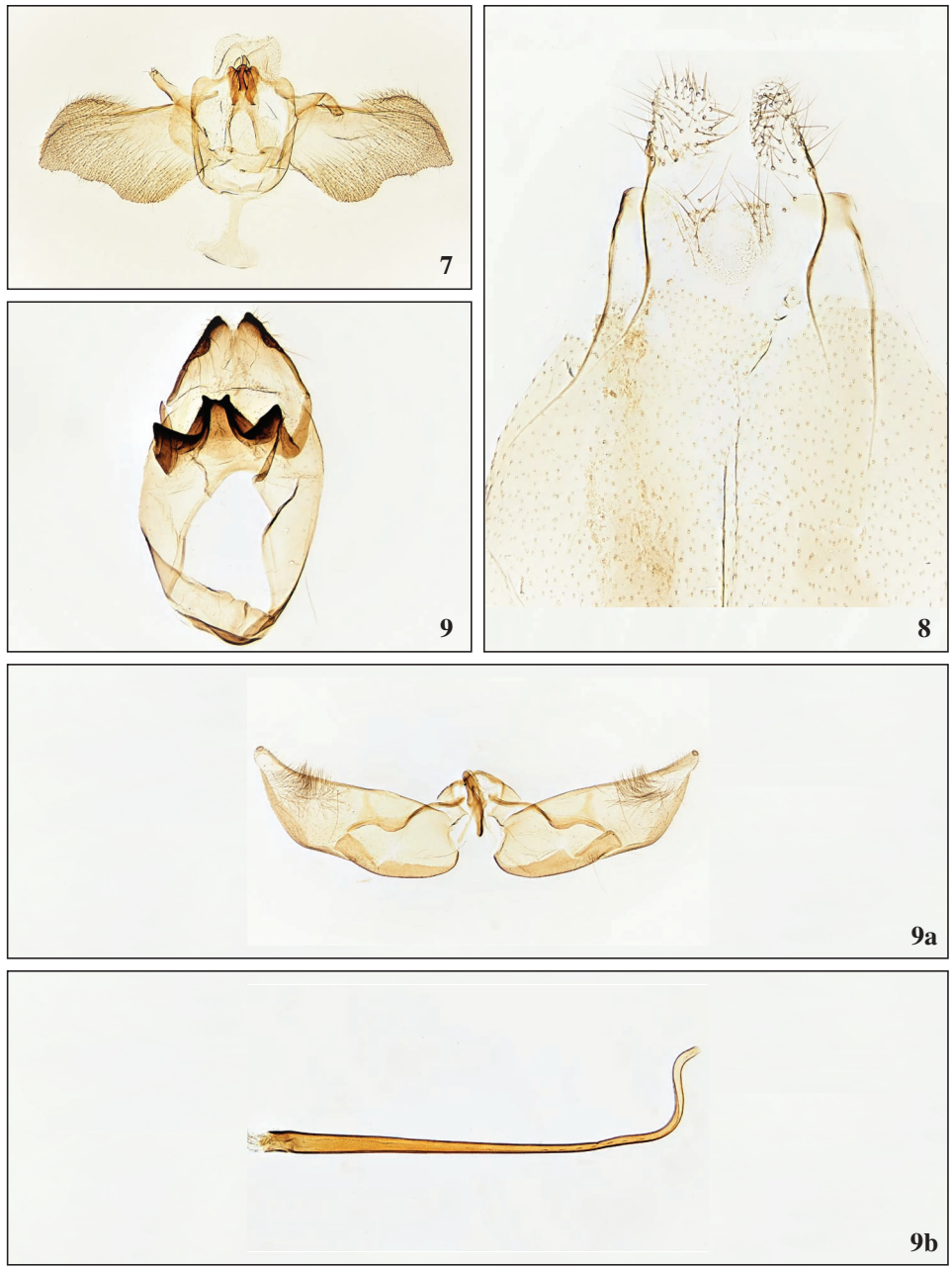
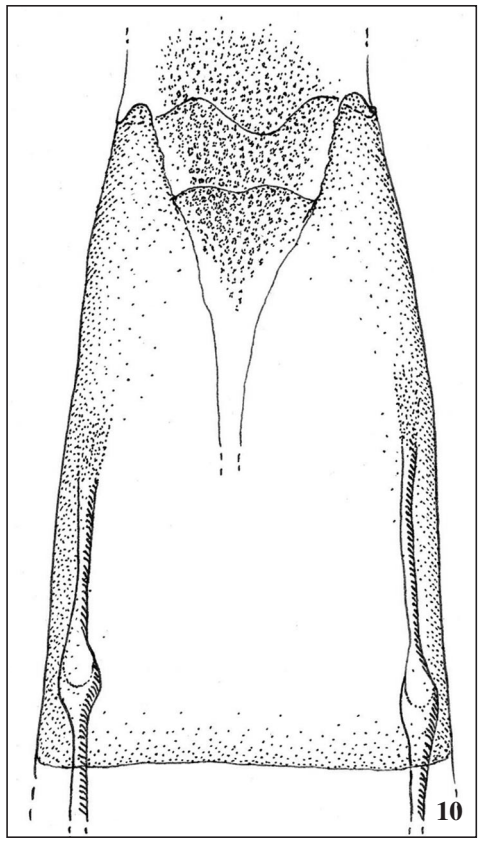
Figs 2-6.– 2. *Infurcitinea canaricola* Gaedike, 2019, ♀, La Palma, 9.5 mm. **3.** *Rhodobates carsteni* Falck, Gaedike & Vives, sp. n., ♂, Lanzarote, 15 mm. **4.** *Rhodobates carsteni* Falck, Gaedike & Vives, sp. n., ♂, Lanzarote, 15 mm (light specimen). **5.** *Tinea laurisilvaella* Falck, Gaedike & Vives, sp. n., ♂, Tenerife, 18.5 mm. **6.** *Tinea laurisilvaella* Falck, Gaedike & Vives, sp. n., ♀, Madeira, 18.5 mm. (dark specimen).



Figs 7-9.– 7. *Infurcitinea canaricola* Gaedike, 2019, ♂, La Palma, GP3035PF. **8.** *Infurcitinea canaricola* Gaedike, 2019, ♀, La Palma, GP3038PF. **9.** *Rhodobates carsteni* Falck, Gaedike & Vives, sp. n., ♂, Lanzarote, uncus-tegumen complex, GP3247PF. **9a.**Valva-saccus complex, GP3247PF. **9b.** Phallus, GP3251PF.



Figs 10-12.– 10. *Rhodobates carsteni* Falck, Gaedike & Vives, sp. n., ♀, Lanzarote, GP9765RG. **11.** *Tinea laurisilvaella* Falck, Gaedike & Vives, sp. n., ♂, Gran Canaria, uncus-tegumen complex, GP3046PF. **11a.** Valva-saccus complex and phallus, GP3046PF. **12.** *Tinea laurisilvaella* Falck, Gaedike & Vives, sp. n., ♀, Gran Canaria, GP2978PF.